# REPORT OF AIR POLLUTION SOURCE TESTING OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM OPERATED BY STERIGENICS U.S., LLC. IN SANTA TERESA, NEW MEXICO ON NOVEMBER 15, 2016

Submitted to:

NEW MEXICO ENVIRONMENT DEPARTMENT
Air Quality Bureau
1301 Siler Road, Building B
Santa Fe, New Mexico 87507

Submitted by:

STERIGENICS U.S., LLC. 2400 Airport Road Santa Teresa, New Mexico 88008

NSR Permit No. 0733-M15

Prepared by:

ECSi PO Box 848 San Clemente, California 92674-0848

Prepared on:

**December 20, 2016** 

ECSi

## **CONTACT SUMMARY**

#### **CLIENT**

Ms. Laura Hartman Environmental Health and Safety STERIGENICS U.S., LLC. 2015 Spring Road, Suite 650 Oak Brook, Illinois 60523

Phone: (630)928-1724

email: <u>LHartman@sterigenics.com</u>

#### **TEST DATE**

November 15, 2016

#### **REGULATORY AGENCY**

NEW MEXICO ENVIRONMENT DEPARTMENT Air Quality Bureau 1301 Siler Road, Building B Santa Fe, New Mexico 87507

Phone: (505)476-4300 FAX: (505)476-4375

email: Stacktest.agb@state.nm.us

#### **TESTING CONTRACTOR**

Daniel P. Kremer Project Manager ECSi, Inc. PO Box 848 San Clemente, California 92674-0848

Phone: (949)400-9145 FAX: (949)281-2169

email: <u>dankremer@ecsi1.com</u>

#### **FACILITY**

Mr. Steve Ortiz General Manager STERIGENICS U.S., LLC. 2400 Airport Road Santa Teresa, New Mexico 88008

Phone: (575)589-9300

email: <u>SOrtiz@sterigenics.com</u>



## **TABLE OF CONTENTS**

			PAGE NO		
CONT	TACT S	UMMARY	i		
TABL	E OF C	CONTENTS	ii		
LIST	LIST OF TABLES				
LIST	OF API	PENDICES	iv		
1.0	INTR	ODUCTION	1		
2.0	EQUI	PMENT	2		
3.0	TESTING				
4.0	RULE/COMPLIANCE REQUIREMENTS				
5.0	TEST METHOD REFERENCE				
	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8	Summary/Introduction EtO Mass-Emissions Measurement Sample Transport GC Injection GC Conditions Calibration Standards Sampling Duration Mass-Emissions Calculations	5 6 6 6 7 7		
6.0	TEST	SCENARIO	8		
7.0	QA/Q	c	9		
	7.1 7.2	Field Testing Quality Assurance Calibration Procedures	9 9		
8.0	TEST	RESULTS	10		
TABL	.ES		11		
APPENDICES					



# LIST OF TABLES

<u>TABLE</u>	<u>DESCRIPTION</u>	
1	Ethylene Oxide Control Efficiency – Backvent	12
2	Ethylene Oxide Control Efficiency – Aeration	13



# **LIST OF APPENDICES**

<u>APPENDIX</u>	DESCRIPTION	PAGE NO
Α	Calibration Data	A-1
В	Run #1 Chromatograms – Backvent	B-1
С	Run #1 Chromatograms – Aeration	C-1
D	Run #2 Chromatograms – Aeration	D-1
E	Run #3 Chromatograms – Aeration	E-1
F	Field Data and Calculation Worksheets	F-1
G	Calibration Gas Certificates	G-1



## 1.0 INTRODUCTION

On Tuesday, November 18, 2015, ECSi performed air pollution source testing of an ethylene oxide (EtO) emission-control system operated by Sterigenics U.S., LLC. in Santa Teresa, New Mexico. The control device tested was a Donaldson Abator catalytic oxidizer, which is currently used to control emissions from two aeration rooms and thirteen sterilization chamber backvents. The purpose of the testing program was to evaluate continued compliance with EPA requirements under the current National Emissions Standards for Hazardous Air Pollutants (NESHAP), Subpart O - Ethylene Oxide Sterilization Facilities, and with requirements in the facility's NSR Permit No. 0733-M15 issued by the New Mexico Environment Department (NMED).



## 2.0 EQUIPMENT

The EtO gas-sterilization system is comprised of thirteen commercial sterilizers, all discharging through dry screw or liquid-ring vacuum pumps to a packed-tower Ceilcote acid scrubber emission control device. Two aeration rooms and thirteen sterilization chamber backvents are all discharged to a Donaldson Abator catalytic oxidizer emission-control device. The gas-sterilization and emission-control equipment consists of the following:

- Thirteen Gas Sterilizers, each comprised of a steam-heated sterilization chamber (varying in size from 13-30 pallet capacity), a dry screw or liquid ring recirculating vacuum pump chamber evacuation system ("chamber vacuum vent"), and a backdraft valve ("chamber backvent");
- Two aeration rooms and three aeration cells, each comprised of a heated aeration chamber and a chamber exhaust system.

Sterilizer vacuum pump emissions are controlled by:

 One packed-tower Ceilcote chemical scrubber, equipped with a packed reaction/interface column, a scrubber fluid recirculation system, a scrubber fluid reaction/storage tank, and a dedicated blower exhaust system.

Aeration room and sterilizer backvent emissions are controlled by:

 One Donaldson EtO Abator catalytic oxidizer, 20,000 SCFM, equipped with a prefilter, a gas-fired heater, an exhaust gas heat exchanger, a reactive catalyst bed, and an exhaust blower.



## 3.0 TESTING

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365(d)(2). EtO concentration measurement for each test run was conducted simultaneously at the inlet and outlet of the catalytic oxidizer during a one-hour interval of the 24-hour aeration process, and during the 15-minute sterilizer backvent duration. A total of three one-hour aeration test runs and one 15-minute backvent test run were performed.

During aeration and backvent testing, EtO concentration at the inlet and the outlet of the catalytic oxidizer was determined using direct source sample injection into the gas chromatograph (GC). All aeration and backvent testing was performed using recently sterilized product. The testing program was conducted in accordance with the procedures outlined in the following sections.



## 4.0 RULE/COMPLIANCE REQUIREMENTS

The facility's Donaldson Abator catalytic oxidizer system was tested to determine compliance with the current federal EPA National Emissions Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR Part 63, Subpart O and the facility's NSR permit. Applicable provisions in the NESHAP standard include Sections 63.362(d) and 63.363(b)(4)(i). Specifically, the current testing was performed to demonstrate continued compliance with the following requirements:

- The emissions from the aeration process must be discharged to control equipment with an EtO emission-reduction efficiency of at least 99.0% by weight. {Section 63.362(d)}
- The emissions from the sterilizer backvents must be discharged to control equipment with an EtO emission-reduction efficiency of at least 99.0%. {NSR Permit Section A803 A.}

Testing is required to demonstrate compliance with these requirements. Source testing of the emission-control device is required annually, in accordance with Federal EPA and NMED requirements.



## 5.0 TEST METHOD REFERENCE

## 5.1 INTRODUCTION

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365(d)(2), using EPA Method 18 as specified in 40CFR, Part 60, Appendix A. EtO concentration measurement for each test run was conducted simultaneously at the inlet and outlet of the catalytic oxidizer during a one-hour interval of the 24-hour aeration process, and during the 15-minute sterilizer backvent duration. A total of three one-hour aeration test runs and one 15-minute backvent test run were performed.

During aeration and backvent testing, EtO concentration at the inlet and the outlet of the catalytic oxidizer was determined using direct source sample injection into the gas chromatograph (GC). All aeration and backvent testing was performed using recently sterilized product.

Operation and documentation of process conditions were performed by personnel from Sterigenics using existing monitoring instruments installed by the manufacturer on the equipment to be tested. In accordance with the procedures established in USEPA CFR40, Part 63, Subpart O, Section 63.363(b)(3), the following parameter was recorded: catalyst bed operating temperature. Process condition data is recorded in Tables 1 and 2.

#### 5.2 ETO CONTROL EFFICIENCY MEASUREMENT

During aeration and backvent testing, EtO concentration at the inlet and outlet of the catalytic oxidizer was determined using direct source sample injection into the GC. Since the source gas flow is identical at the inlet and outlet of the catalytic oxidizer control-efficiency of EtO during aeration and backvent was calculated by comparing the concentration of EtO vented to the system inlet to the concentration of EtO vented from the system outlet.

During backvent and aeration testing, vented gas was analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) was used to quantify inlet EtO concentration, and a photoionization detector (PID) was used to quantify low-level EtO concentration at the emission-control device outlet.



#### 5.3 SAMPLE TRANSPORT

Source gas was pumped to the GC at approximately 1000 cubic centimeters per minute (cc/min) from the sampling ports through two lengths of Teflon<sup>®</sup> sample line, each with a nominal volume of approximately 75 cubic centimeters (cc) and an outer diameter of 0.25 inch. At the inlet, the sampling port was located in the aeration discharge duct, upstream of the oxidizer. At the outlet of the catalytic oxidizer, sampling ports were located in the exhaust stack downstream of the catalyst bed.

#### 5.4 GC INJECTION

Source-gas samples were then injected into the GC which was equipped with two heated sampling loops, each containing a volume of approximately 2cc and maintained at 100 degrees Celsius (C). Injections occurred at approximately one-minute intervals during backvent testing, and at approximately five-minute intervals during aeration testing. Helium was the carrier gas for both the FID and PID.

#### 5.5 GC CONDITIONS

The packed columns for the GC were both operated at 80 degrees C. The columns were stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B. During the analysis, the FID was operated at 250 degrees C. The support gases for the FID were helium (99.999% pure), hydrogen (99.995% pure) and air (99.9999% pure). Any unused sample gas was vented from the GC system back to the inlet of the control device being tested.

#### 5.6 CALIBRATION STANDARDS

The FID was calibrated for mid-range part-per-million-by-volume (ppmv) level analysis using gas proportions similar to the following:

- 1) 100 ppmv EtO, balance nitrogen
- 2) 50 ppmv EtO, balance nitrogen (audit gas)
- 3) 10 ppmv EtO, balance nitrogen
- 4) 1 ppmv EtO, balance nitrogen

The PID was calibrated for low-range ppmv level analyses using gas proportions similar to the following:



- 1) 100 ppmv EtO, balance nitrogen
- 2) 50 ppmv EtO, balance nitrogen (audit gas)
- 3) 10 ppmv EtO, balance nitrogen
- 4) 1 ppmv EtO, balance nitrogen

Each of these calibration standards was in a separate, certified manufacturer's cylinder. Copies of the calibration gas laboratory certificates are attached as Appendix G.

#### 5.7 SAMPLING DURATION

Backvent testing consisted of a one 15-minute test run, which encompassed the entire duration of a single cycle of the backvent process. Since aeration is a 24-hour process at this facility, with constant discharge flow from the aeration chambers to the Donaldson Abator emission-control system, aeration testing consisted of three (3), 1-hour test runs. Each test run was performed with freshly sterilized product in the sterilization chambers and/or aeration rooms.

#### 5.8 CONTROL-EFFICIENCY CALCULATIONS

Control efficiency of EtO was calculated for backvent and aeration. Results of the control-efficiency testing are presented in Section 8.0, and in Tables 1 and 2.



#### 6.0 TEST SCENARIO

Backvent and aeration testing was performed during normal process load conditions. One backvent test run and three aeration test runs were conducted in series to verify the performance of the emission-control device. The testing schedule was as follows:

- 1) Testing equipment was set up and calibrated.
- 2) Backvent Test Run #1 was conducted with freshly sterilized product in sterilization chamber. Sampling was performed at the inlet and the outlet of the catalytic oxidizer.
- 3) Aeration Test Run #1 was conducted with freshly sterilized product in aeration. Sampling was performed at the inlet and the outlet of the catalytic oxidizer.
- 4) Aeration Test Run #2 was conducted with freshly sterilized product in aeration. Sampling was performed at the inlet and the outlet of the catalytic oxidizer.
- 5) Aeration Test Run #3 was conducted with freshly sterilized product in aeration. Sampling was performed at the inlet and the outlet of the catalytic oxidizer.
- 6) Post calibration check was performed, testing equipment was packed.



### 7.0 QA/QC

#### 7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system was leak checked at a vacuum of 15 inches of mercury. The sampling system was considered leak free when the flow indicated by the rotameters fell to zero.

At the beginning of the test, a system blank was analyzed to ensure that the sampling system was free of EtO. Ambient air was introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also provided a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device, and due to the destruction of EtO by the emission-control device which produces carbon dioxide and water vapor. This chromatogram, designated AMB, is included with the calibration data in Appendix A.

#### 7.2 CALIBRATION PROCEDURES

The GC system was calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a point-to-point calibration curve was constructed for each detector. A gas cylinder of similar composition as the calibration gases, but certified by a separate supplier, was used to verify calibration gas composition and GC performance.

All calibration gases and support gases used were of the highest purity and quality available. A copy of the laboratory certification for each calibration gas is attached as Appendix G.



## 8.0 TEST RESULTS

The catalytic oxidizer was found to have an average EtO control efficiency of 99.95% for the backvent process, and 99.98% for the aeration process. During backvent and aeration testing the catalytic oxidizer was operated at 281 degrees F (i.e., bed outlet temperature). In accordance with state and federal requirements, backvent and aeration discharge streams must be vented to control equipment with an EtO emission-reduction efficiency of at least 99 percent by weight. The facility's Donaldson Abator catalytic oxidizer met this requirement.

The test results are summarized in Tables 1 and 2. These tables include results for EtO control efficiency of the emission-control device for backvent and aeration. Chromatograms and chromatographic supporting data are attached as Appendices A through E. Copies of field data and calculation worksheets are attached as Appendix F.



# **TABLES**



# TABLE 1 ETHYLENE OXIDE CONTROL EFFICIENCY - BACKVENT OF AN ETHYLENE OXIDE EMISSION CONTROL DEVICE OPERATED BY STERIGENICS U.S., LLC. IN SANTA TERESA, NEW MEXICO ON NOVEMBER 15, 2016

CYCLE PHASE	INJECTION <u>TIME</u>	INLET ETO CONC. (PPM)(1)	OUTLET ETO CONC. (PPM)(2)	ETO CONTROL EFFICIENCY
Backvent(3)	934	50.2	0.01	99.9801
Backvent	935	272	1.31	99.5184
Backvent	936	99.7	0.01	99.9900
Backvent	937	81.6	0.01	99.9877
Backvent	939	77.1	0.01	99.9870
Backvent	940	77.3	0.01	99.9871
Backvent	941	82.5	0.01	99.9879
Backvent	942	76.6	0.01	99.9869
Backvent	943	76.7	0.01	99.9870
Backvent	944	76.2	0.01	99.9869
Backvent	945	75.5	0.01	99.9868
Backvent	947	74.7	0.01	99.9866
Backvent	948	<u>73.9</u>	<u>0.01</u>	<u>99.9865</u>
TIME-WEIGI	HTED AVERAGE:	91.8	0.1100	99.9507

NMED REQUIRED CONTROL EFFICIENCY: 99%

## Notes:

- (1) PPM = parts per million by volume
- (2) 0.01 ppm is the quantification limit for the detector used at the outlet.
- (3) The backvent phase test run started at 9:33, ended at 9:48.
- (4) The average catalyst bed temperature recorded during the test run was 281 degrees F.

# TABLE 2 ETHYLENE OXIDE CONTROL EFFICIENCY - AERATION OF AN ETHYLENE OXIDE EMISSION CONTROL DEVICE OPERATED BY STERIGENICS U.S., LLC. IN SANTA TERESA, NEW MEXICO ON NOVEMBER 15, 2016

RUN <u>NUMBER</u>	INJECTION <u>TIME</u>	INLET ETO CONC. (PPM)(1)	OUTLET ETO CONC. (PPM)(2)	ETO CONTROL EFFICIENCY
1(3)	949	74.6	0.01	99.9866
1	954	72.3	0.01	99.9862
1	959	68.3	0.01	99.9854
1	1004	69.5	0.01	99.9856
1	1009	110	0.01	99.9909
1	1014	72.8	0.01	99.9863
1	1019	69.3	0.01	99.9856
1	1024	65.4	0.01	99.9847
1	1029	64.0	0.01	99.9844
1	1034	63.6	0.01	99.9843
1	1039	62.9	0.01	99.9841
1	1044	60.4	0.01	99.9834
2(4)	1049	60.5	0.01	99.9835
2 2 2	1054	59.4	0.01	99.9832
2	1059	59.5	0.01	99.9832
	1104	59.7	0.01	99.9832
2	1109	59.5	0.01	99.9832
2 2	1114	59.7	0.01	99.9832
2	1119	59.9	0.17	99.7162
2 2 2	1124	60.2	0.01	99.9834
2	1129	58.0	0.01	99.9828
2	1134	55.6	0.01	99.9820
2	1139	55.0	0.01	99.9818
2	1144	54.7	0.01	99.9817
3(5)	1149	54.2	0.01	99.9815
3	1154	54.2	0.01	99.9815
3	1159	53.0	0.01	99.9811
3	1204	53.4	0.01	99.9813
3	1209	53.5	0.01	99.9813
3 3	1214	52.9	0.01	99.9811
3	1219	53.1	0.01	99.9812
3 3	1224	49.9	0.01	99.9800
3	1229	49.5	0.01	99.9798
3	1234	48.6	0.01	99.9794
3	1239	50.2	0.01	99.9801
3	1244	<u>44.9</u>	<u>0.01</u>	<u>99.9777</u>
TIME-W	EIGHTED AVERAGE:	60.34	0.0144	99.9756

NMED REQUIRED CONTROL EFFICIENCY: 99%

#### Notes:

- (1) PPM = parts per million by volume
- (2) 0.01 ppm is the quantification limit for the detector used at the outlet.
- (3) Aeration Phase Test Run #1 started at 9:48, ended at 10:48.
- (4) Aeration Phase Test Run #2 started at 10:48, ended at 11:48.
- (5) Aeration Phase Test Run #3 started at 11:48, ended at 12:48.
- (6) During aeration testing, the average recorded catalyst bed temperature was 280 deg F

# **APPENDICES**

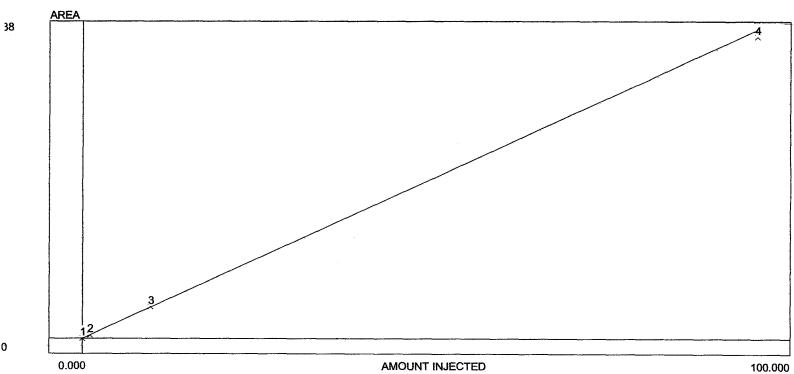


## **APPENDIX A**

**Calibration Data** 



Peak	Name	Start	End	Calibration	Int.Std	Units
1	Dead Vol / Air	0.000	0.350		0.000	
2	Ambient H2O	0.350	0.500		0.000	
3	Ethylene Oxide	0.500	0.600	C:\peak359\1Ster:0.00016.cppm		
4	Acetaldehyde	0.600	0.800		0.000	
5	CO2	0.800	1.000		0.000	



Avg slope of curve: 0.39 Y-axis intercept: 0.00 Linearity: 1.00 Number of levels: 4 SD/rel SD of CF's: 0.2/66.7

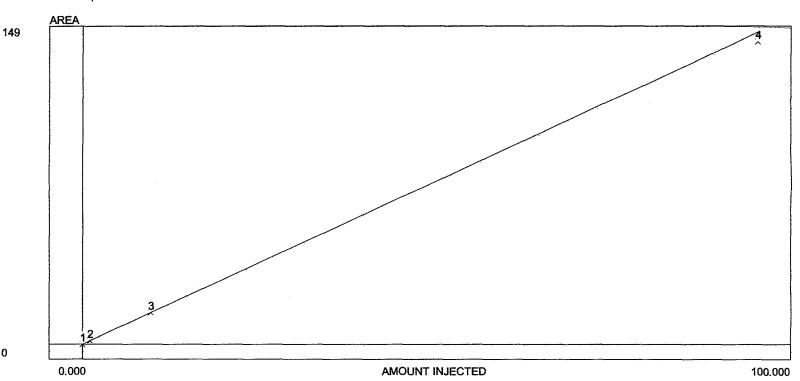
Y=0.3896X r2: 1.0000

Last calibrated: Mon Nov 14 13:53:49 2016

Lvi. Area/ht. Amount		Amount	CF Current		Previous #1Previous #2		
1	0.000	0.000	0.000	0.000	N/A	N/A	
2	0.430	1.100	0.391	0.430	N/A	N/A	
3	4.010	10.100	0.397	4.010	N/A	N/A	
4	38.100	100.000	0.381	38.100	N/A	N/A	

Peak 1	Name Dead Vol / Air	Start 0.000	End 0.350	Calibration	Int.Std   0.000	Units
2 3		0.350	0.500 0.600	C:\neak359\2St	0.000	ากภา
<b>4</b> 5	Acetaldehyde CO2	0.600	0.800 1.000	C:\peak359\2Ster:0.00016.фрт 0.000 0.000		

#### Calibration file: C:\peak359\2SterST2016.cal



Avg slope of curve: 1.54 Y-axis intercept: 0.00 Linearity: 1.00 Number of levels: 4 SD/rel SD of CF's: 0.8/66.7

Y=1.5358X r2: 1.0000

Last calibrated: Mon Nov 14 13:53:06 2016.

Lvi	. Area/ht.	Amount	CF	Current	Previou	s #1Previous #2
1	0.000	0.000	0.000	0.000	N/A	N/A
2	1.730	1,100	1.573	1.730	N/A	N/A
3	15.600	10.100	1.545	15.600	N/A	N/A
4	149.000	100.000	1.490	149.000	N/A	N/A

Data file: 1SterST2016-Amb.CHR (c:\peak359)
Sample: Ambient Background Data file: 2SterST2016-Amb.CHR (c:\peak359) Sample: Ambient Background Operator: D. Kremer Operator: D. Kremer -3.200 32.000 -3.200 32.000 0.0000/ Dead Vol / Air 0.4745/0.416 0.0000/ Ambient H2O Ambient H2O 149.5520/0.433 0.0000/ External Units Component Retention Area Component Retention Area External Units 0.0000 Dead Vol / Air Dead Vol / Air 0.250 1.9440 0.183 16.7255 0.0000

Ambient H2O

Laving, Luci

Client ID: PreCal Analysis date: 11/14/2016 13:22:56

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.433

149.5520

166.2775

0.0000

0.0000

Lad Hallie, Low!

Client ID: PreCal

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ambient H2O

Analysis date: 11/14/2016 13:22:56 Method: Direct Injection

Client: Sterigenics - Santa Teresa

0.416

0.4745

2.4185

0.0000

0.0000

Description: CHANNEL 1 - FID Column: 1% SP-1000, Carbopack B

Components: eto1-100.cpt Components: eto2-100.cpt Data file: 1SterST2016-C01.CHR (c:\peak359) Data file: 2SterST2016-C01.CHR (c:\peak359) Sample: 1.10 ppm EtO std Sample: 1.10 ppm EtO std Operator: D. Kremer Operator: D. Kremer -0.400 64.000 0.1420/0.033 )ead Voi / Air 0.0000/ 4,7740/0.083 Dead Vol / Air 0.0000/ Ambient H2O 2.5755/0.400 0.0000/ 1.7070/0.550 0.0000/ppm 0.4580/0.766 0.0000/ Component Retention Area External Units Component Retention Area External Units

Dead Vol / Air

Ambient H2O

Acetaldehyde

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.083

0.400

0.550

0.766

4.7740

2.5755

1.7070

0.4580

9.5145

0.0000

0.0000

0.0000

0.0000

0.0000 ppm

Client ID: PreCal

Analysis date: 11/14/2016 13:25:44 Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.033

0.550

Dead Vol / Air

Ethylene Oxide

0.0000

0.0000

0.0000 ppm

0.1420

0.4260

0.5680

Client ID: PreCal

Carrier: HELIUM Temp. prog: eto-100.tem

Analysis date: 11/14/2016 13:25:44 Method: Direct Injection Description: CHANNEL 1 - FID

Components: eto2-100.cpt Components: eto1-100.cpt Data file: 1SterST2016-C02.CHR (c:\peak359) Sample: 1.10 ppm EtO std Data file: 2SterST2016-C02.CHR (c:\peak359) Sample: 1.10 ppm EtO std Operator: D. Kremer Operator: D. Kremer -0.400 4.000 64.000 Component 6.6790/0.050 0.2090/0.050 0.0000/ 0.0000/ Dead Vol / Air Dead Vol / Air B490/0.450 0.0000/ Ambient H2O 0.4215/0.550 1,7479/0.566 0.0000/ppm Ethylene Oxide 4.1620/0.683 0.0000/ External Units Component External Units Component Retention Area Retention Area

Dead Vol / Air

Ambient H2O

Acetaldehyde

Ethylene Oxide

Client: Sterigenics - Santa Teresa

0.050

0.550

0.2090

0.4215

0.6305

0.0000

0.0000

0.0000 ppm

Description: CHANNEL 1 - FID Column: 1% SP-1000, Carbopack B

Client ID: PreCal

Carrier: HELIUM

Temp. prog: eto-100.tem

Dead Vol / Air

Ethylene Oxide

Analysis date: 11/14/2016 13:27:12

Method: Direct Injection

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.050

0.450

0.566

0.683

6.6790

3.8490

1.7470

4.1620

16.4370

0.0000

0.0000

0.0000

0.0000

0.0000 ppm

Client ID: PreCal

Analysis date: 11/14/2016 13:27:12

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Method: Direct Injection Method: Direct Injection Description: CHANNEL 1 - FID Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B Column: 1% SP-1000, Carbopack B Carrier: HELIUM Carrier: HELIUM Temp. prog: eto-100.tem Temp. prog: eto-100.tem Components: eto2-100.cpt Components: eto1-100.cpt Data file: 1SterST2016-C03.CHR (c:\peak359) Sample: 10.1 ppm EtO std Data file: 2SterST2016-C03.CHR (c:\peak359) Sample: 10.1 ppm EtO std Operator: D. Kremer Operator: D. Kremer 8,000 -12.800 128.000 0.1435/0.033 Dead Vol / Air 4,2560/0.066 Dead Vol / Air 0.0000/ Ambient H2O 4.0910/0.400 0,0000/

CO2

Client: Sterigenics - Santa Teresa

Client ID: PreCal

Analysis date: 11/14/2016 13:31:24

15.2105/0.533

0.5120/0,650

0.0790/0.850

24.1485

0.0000

0.0000/ppm

0.0000/

0.0000/

Component Retention Area External Units Component Retention External Units Area 0.033 0.0000 Dead Vol / Air 0.1435 Dead Vol / Air 0.066 4.2560 0.0000 Ethylene Oxide 0.550 4.0430 0.0000 ppm Ambient H2O 0.400 4.0910 0.0000 0.0000 ppm Ethylene Oxide 0.533 15.2105 4.1865 0.0000 Acetaldehyde 0.650 0.5120 0.0000 CO2 0.850 0.0790 0.0000

0.0000/ppm

Client: Sterigenics - Santa Teresa

4.0430/0.550

Client ID: PreCal

Analysis date: 11/14/2016 13:31:24

Temp. prog: eto-100.tem Temp. prog: eto-100.tem Components: eto2-100.cpt Components: eto1-100.cpt Data file: 1SterST2016-C04.CHR (c:\peak359)
Sample: 10.1 ppm EtO std Data file: 2SterST2016-C04.CHR (c:\peak359) Sample: 10.1 ppm EtO std Operator: D. Kremer Operator: D. Kremer -0.800 8.000 -12.800 128.000 7.9430/0.083 Dead Vol / Air 0.0000/ Ambient H2O 3.6750/0,383 0.0000/ 15.9270/0.550 0.0000/ppm 3.9700/0.566 0.0000/ppm Acetaldehyde 0.0985/0.700 0.0000/ CO2 0.6020/0.816 0.0000/ Component Retention Area External Units Component Retention Area External Units

Dead Vol / Air

Ambient H2O

Acetaldehyde

CO2

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.083

0.383

0.550

0.700

0.816

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000 ppm

7.9430

3.6750

15.9270

0.0985

0.6020

28.2455

Client ID: PreCal Analysis date: 11/14/2016 13:33:21

Carrier: HELIUM

Method: Direct Injection
Description: CHANNEL 2 - PID

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Client ID: PreCal

Analysis date: 11/14/2016 13:33:21 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

3.9700

3.9700

0.0000 ppm

0.0000

0.566

Ethylene Oxide

Temp. prog: eto-100.tem Temp. prog: eto-100.tem Components: eto1-100.cpt Components: eto2-100.cpt Data file: 1SterST2016-C05.CHR (c:\peak359) Sample: 100 ppm EtO std Data file: 2SterST2016-C05.CHR (c:\peak359) Sample: 100 ppm EtO std Operator: D. Kremer Operator: D. Kremer -6.400 64,000 -51,200 512,000 0.2145/0.050 0.0000/ Dead Vol / Altr 3.6510/0.083 0.0000/ppi 39.0070/0.566 Ethylene Oxide maa\0000.C 0.0000/ 0.0820/0.800 0.0000/ CO2 0.2450/0.883 0.0000/

Component

Dead Vol / Air

Ethylene Oxide

Acetaldehyde

CO<sub>2</sub>

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Retention

0.083

0.550

0.700

0.883

Area

8.6510

0.1610

0.2450

147.0790

156.1360

External Units

0.0000 ppm

0.0000

0.0000

0.0000

0.0000

Client ID: PreCal

Carrier: HELIUM

Analysis date: 11/14/2016 13:36:20

Method: Direct Injection
Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Retention

0.050

0.566

Area

0.2145

39.0070

39.2215

External

0.0000

0.0000

0.0000 ppm

Units

Client ID: PreCal

Analysis date: 11/14/2016 13:36:20 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Component

Dead Vol / Air

Ethylene Oxide

Client: Sterigenics - Santa Teresa Client ID: PreCal

Analysis date: 11/14/2016 13:38:52 Method: Direct Injection Description: CHANNEL 1 - FID

Column: 1% SP-1000, Carbopack B

0.550

37.2240

37.4820

0.0000 ppm

0.0000

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto1-100.cpt

Data file: 1SterST2016-C06.CHR (c:\peak359) Sample: 100 ppm EtO std

Operator: D. Kremer

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Client ID: PreCal

Analysis date: 11/14/2016 13:38:52 Method: Direct Injection Description: CHANNEL 2 - PID

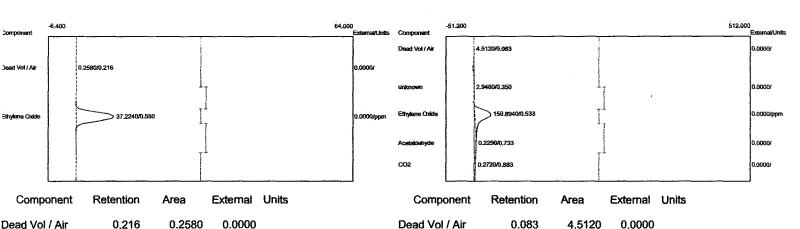
Column: 1% SP-1000, Carbopack B

0.533

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterST2016-C06.CHR (c:\peak359)

Sample: 100 ppm EtO std Operator: D. Kremer



Ethylene Oxide

Acetaldehyde

CO<sub>2</sub>

0.2290 0.0000 0.733 0.883 0.2720 0.0000

0.0000 ppm

155.9070 0.0000

150.8940

Laurianic. Loci Client: Sterigenics - Santa Teresa Client ID: PreCal Analysis date: 11/14/2016 13:52:07 Method: Direct Injection Description: CHANNEL 1 - FID

Column: 1% SP-1000, Carbopack B Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1SterST2016-C07.CHR (c:\peak359)

Sample: 48.8 ppm EtO std

Operator: D. Kremer

Client: Sterigenics - Santa Teresa

Client ID: PreCal

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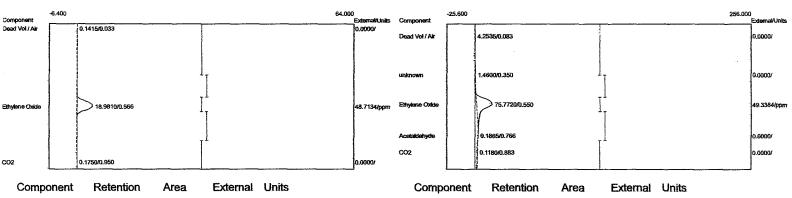
Analysis date: 11/14/2016 13:52:07 Method: Direct Injection Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterST2016-C07.CHR (c:\peak359)

Sample: 48.8 ppm EtO std Operator: D. Kremer



Dead Vol / Air 0.033 0.1415 0.0000 Dead Vol / Air 0.083 0.0000 4.2535 48.7134 ppm 49.3384 ppm Ethylene Oxide 0.566 18.9810 Ethylene Oxide 0.550 75.7720 0.950 Acetaldehyde 0.0000 CO2 0.1750 0.766 0.1865 0.0000 CO2 0.883 0.1180 0.0000 19.2975 48.7134

80.3300 49.3384

Analysis date: 11/15/2016 08:00:54 Analysis date: 11/15/2016 08:00:54 Method: Direct Injection Method: Direct Injection Description: CHANNÉL 1 - FID Description: CHANNÉL 2 - PID Column: 1% SP-1000, Carbopack B Column: 1% SP-1000, Carbopack B Carrier: HELIUM Carrier: HELIUM Temp. prog: eto-100.tem Temp. prog: eto-100.tem Components: eto1-100.cpt Components: eto2-100.cpt Data file: 2SterST2016-C08.CHR (c:\peak359) Data file: 1SterST2016-C08.CHR (c:\peak359) Sample: 48.8 ppm EtO std Sample: 48.8 ppm EtO std Operator: D. Kremer Operator: D. Kremer 64,000 -25.600 256.000 Component Dead Vol / Alr 0.2460/0.033 0.0000/ 9.5790/0.066 Dead Vol / Alt 0.0000/ 2.1265/0.400 Ambient H2O 0.0000/ 74.1190/0.533

CO2

Client: Sterigenics - Santa Teresa

0.0930/0.733

0.1665/0.833

Retention

0.066

0.400

0.533

0.733

0.833

Агеа

9.5790

2.1265

86.0840

Client ID: PreCal

Units Component Retention Area External Component Dead Vol / Air 0.033 0.2460 0.0000 Dead Vol / Air 0.550 18.7280 Ambient H2O Ethylene Oxide 48.0641 ppm Ethylene Oxide 18.9740 48.0641 Acetaldehyde CO2

Client: Sterigenics - Santa Teresa

18.7280/0.550

Client ID: PreCal

48.2621 ppm 74.1190 0.0930 0.0000 0.1665 0.0000

External Units

0.0000

0.0000

48.2621

0.0000/

0.0000/

Lau Hairie. Looi Client: Sterigenics - Santa Teresa Client ID: PostCal

Analysis date: 11/15/2016 12:45:27 Method: Direct Injection Description: CHANNEL 1 - FID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto1-100.cpt

Data file: 1SterST2016-C09.CHR (c:\peak359) Sample: 48.8 ppm EtO std

Operator: D. Kremer

Client: Sterigenics - Santa Teresa

Client ID: PostCal

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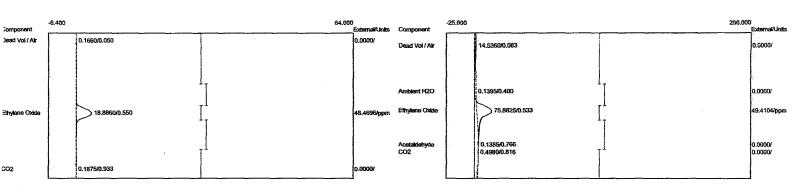
Analysis date: 11/15/2016 12:45:27 Method: Direct Injection Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterST2016-C09.CHR (c:\peak359)
Sample: 48.8 ppm EtO std

Operator: D. Kremer



Component	Retention	Area	External Units	Component	Retention	Area	External Units	
Dead Vol / Air	0.050	0.1660	0.0000	Dead Vol / Air	0.083	14.5360	0.0000	
Ethylene Oxide	0.550	18.8860	48.4696 ppm	Ambient H2O	0.400	0.1395	0.0000	
CO2	0.933	0.1875	0.0000	Ethylene Oxide	0.533	75.8825	49.4104 ppm	
				Acetaldehyde	0.766	0.1385	0.0000	
		19.2395	48.4696	CO2	0.816	0.4980	0.0000	

91.1945 49.4104

# **APPENDIX B**

Run #1 Chromatograms – Backvent



Data file: 15terST2016-B01.CHR (c:\peak359) Sample: Abator Inlet Operator: D. Kremer Data file: 2SterST2016-B01.CHR (c:\peak359) Sample: Abator Outlet Operator: D. Kremer -3.200 32.000 -6.400 64.000 14.8910/0.066 Dead Vol / Air 0.00000 1.7610/0.233 Dead Vot / Air 182.6570/0,400 Ambient H2O 50.2225/ppm External Units Component Retention Area Component Retention Area External Units 0.066 Dead Vol / Air 0.233 1.7610 0.0000 Dead Vol / Air 0.0000 14.8910

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack-B

0.566

19.5690

21.3300

50.2225 ppm

50.2225

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ethylene Oxide

Analysis date: 11/15/2016 09:34:29 Method: Direct Injection

Description: CHANNEL 1 - FID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

182.6570

197.5480

0.0000

0.0000

Client ID: Backvent Analysis date: 11/15/2016 09:34:29

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Method: Direct Injection
Description: CHANNEL 2 - PID

Components: eto1-100.cpt Components: eto2-100.cpt Data file: 2SterST2016-B02.CHR (c:\peak359) Data file: 1SterST2016-B02.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -12.800 128.000 64.000 5.0000/Units 1.7650/0.233 0.0000/ Dead Vot / Air Dead Vol / Air 0.0000/ Ethylene Oxide 2.0060/0.550 .5890/0.600 0.0000/ 0.0000/ Component Retention External Units Component Retention External Units Area Area 0.0000 0.0000 Dead Vol / Air 0.233 1.7650 Dead Vol / Air 0.283 6.0445

Ambient H2O

Acetaldehyde

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.416

0.550

0.733

Ø.0000

0.0000

1.3062

1.3062 ppm

23.3950

2.0060

1.0050

32.4505

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Analysis date: 11/15/2016 09:35:35

Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.583

106.2710 272.7371 ppm

108.0360 272.7371

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Ethylene Oxide

Analysis date: 11/15/2016 09:35:35

Method: Direct Injection

Description: CHANNEL 1 - FID

Data file: 1SterST2016-B03.CHR (c:\peak359) Data file: 2SterST2016-B03.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6,400 64.000 -6.400 64.000 Component 6.5680/0.050 Dead Vol / Air ก กกกก/ 1,7520/0.250 0.0000/ 93.6670/ppm Component Retention **External Units** Retention External Units Area Component Area

Dead Vol / Air

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.250

0.583

1.7520

36.4970

38.2490

0.0000

93.6670

93.6670 ppm

Client ID: Backvent Analysis date: 11/15/2016 09:36:54

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Ethylene Oxide

Method: Direct Injection

Description: CHANNEL 1 - FID

Lav Hailie. Luci

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Analysis date: 11/15/2016 09:36:54

Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.050

0.416

16.5680

183.2450

199.8130

0.0000

0.0000

0.0000

Data file: 2SterST2016-B04.CHR (c:\peak359) Data file: 1SterST2016-B04.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 -6.400 64.000 Component 18.2320/0.050 Dead Vol / Air 0.0000/ 1.7820/0.233 175.4765/0.400 0.0000/ Component Retention External Units Component External Units Area Retention Area Dead Vol / Air 0.233 1.7820 0.0000 Dead Vol / Air 0.050 18.2320 0.0000

Ambient H2O

81.5868 ppm

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

175.4765

193.7085

0.0000

0.0000

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Analysis date: 11/15/2016 09:37:59

Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

31.7900

33.5720 81.5868

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Ethylene Oxide

Analysis date: 11/15/2016 09:37:59

Method: Direct Injection

Description: CHANNEL 1 - FID

Components: eto1-100 cpt Data file: 1SterST2016-B05.CHR (c:\peak359) Data file: 2SterST2016-B05.CHR (c:\peak359) Sample: Abator Outlet Sample: Abator Inlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 -6.400 0.0000/Units 1.7830/0.233 0.0000/ Dead Vol / Air Ambient H2O 171.7670/0.400 0.0000/ 30.0560/0.566 77.1366/ppm Component Retention External Units Component Retention Area External Units Area

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

171.7670

171.7670

0.0000

0.0000

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Analysis date: 11/15/2016 09:39:05

Method: Direct Injection
Description: CHANNEL 2 - PID

Lab Hanie, Looi

Client ID: Backvent

Temp. prog: eto-100.tem

Dead Vol / Air

Ethylene Oxide

Analysis date: 11/15/2016 09:39:05

Method: Direct Injection

Description: CHANNEL 1 - FID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B Carrier: HELIUM

0.233

0.566

1.7830

30.0560

31.8390

0.0000

77.1366

77.1366 ppm

Data file: 1SterST2016-B06.CHR (c:\peak359) Data file: 2SterST2016-B06.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64,000 64.000 0.0000/Units 1.7770/0.233 0.0000/ 78.2795/0.400 30.1200/0.566 Component Retention Area External Units Component Retention External Units Area Dead Vol / Air 0.233 0.0000 1.7770 Ambient H2O 0.400 178.2795 0.0000

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

178.2795

0.0000

Client ID: Backvent Analysis date: 11/15/2016 09:40:17 Method: Direct Injection

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

30.1200

31.8970 77.3009

77.3009 ppm

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ethylene Oxide

Analysis date: 11/15/2016 09:40:17 Method: Direct Injection Description: CHANNEL 1 - FID

Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 64.000 0.0000/Unit Dead Vol / Air 1,7530/0,250 179.1520/0.400 0.0000/ 2.4543*t*ppm Component Retention External Units Area Component Retention External Units Area Dead Vol / Air 0.250 1.7530 0.0000 Ambient H2O 0.400 179.1520 0.0000 Ethylene Oxide 0.566 32.1280 82.4543 ppm

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 2SterST2016-B07.CHR (c:\peak359)

179.1520

0.0000

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Analysis date: 11/15/2016 09:41:22 Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-B07.CHR (c:\peak359)

33.8810

82.4543

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Analysis date: 11/15/2016 09:41:22

Method: Direct Injection
Description: CHANNEL 1 - FID

Data file: 1SterST2016-B08.CHR (c:\peak359)
Sample: Abator Inlet
Operator: D, Kremer Data file: 2SterST2016-B08.CHR (c:\peak359) Sample: Abator Outlet Operator: D. Kremer 6.400 64,000 64.000 10.0000/Units 1.7640/0.233 Dead Vol / Air 0.0000/ Ambient H2O 174,3450/0,400 0.0000/ 29.8430/0.566 76.5900/ppm Retention External Units Component Area Component Retention Area External Units

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

174.3450

174.3450

0.0000

0.0000

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Analysis date: 11/15/2016 09:42:32

Method: Direct Injection
Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.233

0.566

1.7640

29.8430

31.6070

0.0000

76.5900

76.5900 ppm

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Ethylene Oxide

Analysis date: 11/15/2016 09:42:32

Method: Direct Injection

Description: CHANNEL 1 - FID

Temp. prog: eto-100.tem Temp. prog: eto-100.tem Components: eto1-100.cpt Components: eto2-100.cpt Data file: 1SterST2016-B09.CHR (c:\peak359) Data file: 2SterST2016-B09.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 6.400 64.000 -6.400 64.000 Externel/Units Dead Vol / Altr 1.8660/0.250 0.0000/ Ambient H2O 0.2995/0.366 0.0000/ 176.7610/0.400 Ambient H2O 0.0000/ 76.6503/ppm Component Retention External Units Area Component Retention External Units Агеа 176.7610 Dead Vol / Air 0.250 1.8660 0.0000 Ambient H2O 0.400 0.0000 0.0000 Ambient H2O 0.366 0.2995

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

176.7610

0.0000

Client ID: Backvent

Carrier: HELIUM

Analysis date: 11/15/2016 09:43:37

Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

29.8665

32.0320

76.6503 ppm

76.6503

Client ID: Backvent

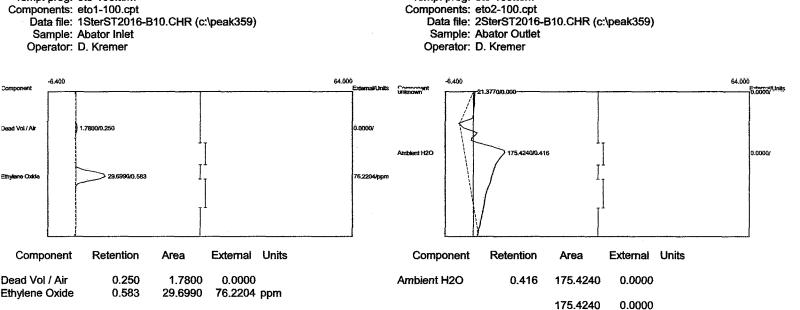
Carrier: HELIUM

Ethylene Oxide

Analysis date: 11/15/2016 09:43:37

Method: Direct Injection

Description: CHANNEL 1 - FID



Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Analysis date: 11/15/2016 09:44:42 Method: Direct Injection
Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

31,4790

76.2204

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Analysis date: 11/15/2016 09:44:42

Method: Direct Injection Description: CHANNEL 1 - FID

Components: eto2-100.cpt
Data file: 2SterST2016-B11.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64,000 64.000 Dead Vol / Air 175.3330/0.400 0.0000/ 75.4531/ppm External Units Component Retention Component Retention External Units Area Area 0.233 0.0000 Dead Vol / Air 1.8020 **Ambient H2O** 0.400 175.3330 0.0000 Ethylene Oxide 0.566 29.4000 75.4531 ppm

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.0000

175.3330

Client ID: Backvent

Carrier: HELIUM Temp. prog: eto-100.tem

Analysis date: 11/15/2016 09:45:55 Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-B11.CHR (c:\peak359)

31.2020

75.4531

Client ID: Backvent Analysis date: 11/15/2016 09:45:55

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Method: Direct Injection Description: CHANNÉL 1 - FID

Data file: 1SterST2016-B12.CHR (c:\peak359) Data file: 2SterST2016-B12.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64,000 64.000 0.0000/Units Dead Vol / Alr 1,7770/0,233 0.0000/ Ambient H2O 0.0000/ 29.1160/0.566 74.7242/ppm Component Retention External Units Area Component Retention External Units Area 0.233 Dead Vol / Air 1.7770 0.0000 Ambient H2O 0.400 177.2060 0.0000 Ethylene Oxide 0.566 29.1160 74.7242 ppm

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

177.2060

0.0000

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Analysis date: 11/15/2016 09:46:59 Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

30.8930

74.7242

Client ID: Backvent

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100 cpt

Analysis date: 11/15/2016 09:46:59

Method: Direct Injection
Description: CHANNEL 1 - FID

Carrier: HELIUM Carrier: HELIUM Temp. prog: eto-100.tem Temp. prog: eto-100.tem Components: eto1-100.cpt Components: eto2-100.cpt
Data file: 2SterST2016-B13.CHR (c:\peak359) Data file: 1SterST2016-B13.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64,000 External/Units 10.0000/ Dead Vol / Air 1.7530/0.250 0.0000/ 0.0000/ Ambient H2O 177.0410/0.400 73.9158/ppm Component Component Retention External Units Retention External Units Area Area 0.0000 Dead Vol / Air 0.250 1.7530 Ambient H2O 0.400 177.0410 0.0000 Ethylene Oxide 0.566 28.8010 73.9158 ppm

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

177.0410

0.0000

Client ID: Backvent

Analysis date: 11/15/2016 09:48:08

Method: Direct Injection

Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

30.5540 73.9158

Client ID: Backvent

Analysis date: 11/15/2016 09:48:08

Method: Direct Injection

Description: CHANNEL 1 - FID

## **APPENDIX C**

Run #1 Chromatograms – Aeration



Components: eto1-100.cpt Components: eto2-100.cpt Data file: 1SterST2016-1A01.CHR (c:\peak359) Data file: 2SterST2016-1A01.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 5.0000/Units 1.8180/0.250 0.0000/ Dead Vol / Air 0.0000/ External Units Component Retention Area Component Retention External Units Area 0.250 0.0000 Dead Vol / Air 1.8180 Ambient H2O 0.400 177.9290 0.0000 Ethylene Oxide 0.566 29.0610 74.5830 ppm 177.9290 0.0000

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Client ID; Aer#1

Analysis date: 11/15/2016 09:49:15

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

30.8790

74.5830

Client ID: Aer#1

Analysis date: 11/15/2016 09:49:15 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Data file: 2SterST2016-1A02.CHR (c:\peak359) Data file: 1SterST2016-1A02.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64,000 -6.400 15.7370/0.083 Dead Vol / Air 0.0000/ 1.7730/0.250 0.0000/ Ethylene Oxide Component Retention External Units Component Retention External Units Area Area 0.0000 Dead Vol / Air 0.250 1.7730 Dead Vol / Air 0.083 15.7370 0.0000

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

180.7430

196.4800

0.0000

0.0000

Client ID: Aer#1

Analysis date: 11/15/2016 09:54:07 Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

28.1840

29.9570

72.3323 ppm

72.3323

0.566

Client ID: Aer#1

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ethylene Oxide

Analysis date: 11/15/2016 09:54:07 Method: Direct Injection Description: CHANNEL 1 - FID

Components: eto1-100.cpt Components: eto2-100.cpt Data file: 1SterST2016-1A03.CHR (c:\peak359) Data file: 2SterST2016-1A03.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64,000 64.000 Component Dead Vol / Air 12.9810/0.083 1.7570/0.233 173.2790/0.400 0.0000/ 68.3107/ppm Component Retention External Units Area Component Retention External Units Агеа

Dead Vol / Air

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.083

0.400

12.9810

173.2790

186.2600

0.0000

0.0000

0.0000

Client ID: Aer#1

Analysis date: 11/15/2016 09:59:30 Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.233

0.566

1.7570

26.6170

28.3740 68.3107

0.0000

68.3107 ppm

Client ID: Aer#1

Analysis date: 11/15/2016 09:59:30

Method: Direct Injection
Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Dead Vol / Air

Ethylene Oxide

Sample: Abator Inlet Operator: D. Kremer Sample: Abator Outlet Operator: D. Kremer -6.400 64,000 -6.400 64.000 15.5670/0.083 0.0000.0 Dead Vol / Air 1.7995/0.250 0.0000/ 0.0000/ 69.5272/ppm Component Retention Area External Units Component Retention External Units Area 0.0000 Dead Vol / Air 0.250 1.7995 Dead Vol / Air 0.083 15.5670 0.0000 Ethylene Oxide 0.583 27.0910 69.5272 ppm Ambient H2O 175.5910 0.0000 0.416

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 2SterST2016-1A04.CHR (c:\peak359)

191.1580

0.0000

Client ID: Aer#1

Analysis date: 11/15/2016 10:04:02

Method: Direct Injection
Description: CHANNEL 2 - PID

Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-1A04.CHR (c:\peak359)

28.8905

69.5272

Client ID: Aer#1

Analysis date: 11/15/2016 10:04:02 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Components: eto1-100.cpt Components: eto2-100.cpt Data file: 2SterST2016-1A05.CHR (c:\peak359) Data file: 1SterST2016-1A05.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 18,5930/0.083 Dead Vol / Air 100000.0 Dead Vol / Air 1,7655/0,250 0.0000/ Ambient H2O 174.9500/0.416 0.0000/ 42 9310/0 583 110.1794/ppm Component Retention External Units External Units Area Component Retention Area Dead Vol / Air 0.250 1.7655 0.0000 Dead Vol / Air 0.083 18.5930 0.0000

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.416

174.9500

193.5430

0.0000

0.0000

Client ID: Aer#1

Analysis date: 11/15/2016 10:09:43

Method: Direct Injection
Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.583

42.9310 110,1794 ppm

44.6965 110.1794

Client ID: Aer#1

Analysis date: 11/15/2016 10:09:43

Method: Direct Injection Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Ethylene Oxide

Carrier: HELIUM Carrier: HELIUM Temp. prog: eto-100.tem Components: eto1-100.cpt Temp. prog: eto-100.tem Components: eto2-100.cpt Data file: 1SterST2016-1A06.CHR (c:\peak359) Data file: 2SterST2016-1A06.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 64.000 22.6760/0.083 Dead Vol / Air 0.0000/ Dead Vol / Air 1,7770/0,233 28.3585/0.566 Component Retention External Units Area Component Retention External Units Area Dead Vol / Air 0.233 1.7770 0.0000 Dead Vol / Air 0.083 0.0000 22.6760 Ethylene Oxide 0.566 28.3585 72.7801 ppm Ambient H2O 0.400 0.0000 172.7570

Client: Sterigenics - Santa Teresa

195.4330

0.0000

Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

Client ID: Aer#1

Analysis date: 11/15/2016 10:14:15 Method: Direct Injection

Client: Sterigenics - Santa Teresa

30.1355 72.7801

Description: CHANNEL 1 - FID Column: 1% SP-1000, Carbopack B

Client ID: Aer#1

Analysis date: 11/15/2016 10:14:15 Method: Direct Injection

Data file: 1SterST2016-1A07.CHR (c:\peak359) Data file: 2SterST2016-1A07.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.4**0**0 64.000 64.000 Component Dead Vol / Air 22.4460/0.033 0.0000/ 1.7290/0.250 0.0000/ 186.0220/0.400 0.0000/ 9.3270/ppm External Units Component Retention Component Retention External Units Area Area

Dead Vol / Air

Ambient H2O

Client: Sterigenics - Santa Teresa

0.033

0.400

22.4460

186.0220

208.4680

0.0000

0.0000

0.0000

Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Client ID: Aer#1

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Analysis date: 11/15/2016 10:19:09 Method: Direct Injection

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.250

0.566

0.0000

69.3270

69.3270 ppm

1.7290

27.0130

28.7420

Client ID: Aer#1

Analysis date: 11/15/2016 10:19:09 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Ethylene Oxide

Data file: 1SterST2016-1A08.CHR (c:\peak359) Data file: 2SterST2016-1A08.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 External/Units -6.400 64.000 Component 0.0000/ 0.0000/ 183.9400/0,400 Ambient H2O 0.0000/ 65.4337/ppm External Units Component Retention Area Component Retention Area External Units

Dead Vol / Air

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.083

0.400

18.2885

183.9400

202.2285

0.0000

0.0000

0.0000

Client ID: Aer#1

Analysis date: 11/15/2016 10:24:21

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.250

0.566

1.8240

25.4960

27.3200

0.0000

65.4337

65.4337 ppm

Client ID: Aer#1

Analysis date: 11/15/2016 10:24:21

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Ethylene Oxide

Data file: 2SterST2016-1A09.CHR (c:\peak359) Data file: 1SterST2016-1A09.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 -6.400 64.000 -6.400 17.7320/0.083 0.0000/ 1.7420/0.250 0.0000/ 0.0000/ 64.0401/ppm Component Retention External Units Component Retention External Units Area Area Dead Vol / Air 0.250 1.7420 0.0000 Dead Vol / Air 0.083 17.7320 0.0000

Ambient H2O

Lab name: ECSI

Client ID: Aer#1

Analysis date: 11/15/2016 10:29:44

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

179.8870

197.6190

0.0000

0.0000

Lab name: ECSI

Client ID: Aer#1

Analysis date: 11/15/2016 10:29:44

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto1-100.cpt

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

24.9530

26.6950

64.0401 ppm

64.0401

Data file: 1SterST2016-1A10.CHR (c:\peak359) Sample: Abator Inlet Data file: 2SterST2016-1A10.CHR (c:\peak359) Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6.400 64.000 19.4915/0.083 Dead Vol / Ali 0.0000/ Ambient H2O 180,2900/0,400 0.0000/ Component Retention Area External Units Component Retention Area External Units Dead Vol / Air 0.250 0.0000 Dead Vol / Air 1.7795 0.083 19.4915 0.0000

Ambient H2O

Lab liallie. Loci

Client ID: Aer#1

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Analysis date: 11/15/2016 10:34:18 Method: Direct Injection Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

180.2900

199.7815

0.0000

0.0000

Lab Haille. LOOI

Client ID: Aer#1

Analysis date: 11/15/2016 10:34:18

Method: Direct Injection
Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

24.7830

26.5625

63.6038 ppm

63.6038

Data file: 1SterST2016-1A11.CHR (c:\peak359) Data file: 2SterST2016-1A11.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 External/Unit 64,000 -6.400 20.8695/0.083 Dead Vol / Air 0.0000/ 1 8040/0.250 0.0000/ Dead Vol / Air Ambient H2O 181.0710/0.400 0.0000/ Component Retention Area External Units Component Retention Area External Units 0.250 0.0000 Dead Vol / Air 1.8040 Dead Vol / Air 0.083 20.8695 0.0000 0.566 24.5085 62.8994 ppm Ambient H2O 0.400 0.0000 Ethylene Oxide 181.0710

62.8994

26.3125

Lau Haille, Looi

Client ID: Aer#1

Analysis date: 11/15/2016 10:39:08

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem Components; eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.0000

201.9405

Lab hame. ECOI

Client ID: Aer#1

Analysis date: 11/15/2016 10:39:08

Method: Direct Injection

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Client: Sterigenics - Santa Teresa

Description: CHANNEL 1 - FID Column: 1% SP-1000, Carbopack B

Data file: 2SterST2016-1A12.CHR (c:\peak359) Data file: 1SterST2016-1A12.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6.400 64,000 14.7170/0.066 Dead Vol / Air 0.0000/ 1.8410/0.233 0.0000/ Dead Vol / Air 179.8810/0.400 Ambient H2O 0.0000/ 23.5330/0.566 60.3958/ppn Component Retention External Units Area Component Retention Area External Units Dead Vol / Air 0.233 1.8410 0.0000 Dead Vol / Air 0.066 14.7170 0.0000

Ambient H2O

60.3958 ppm

60.3958

Lab name: ECSI

Client ID: Aer#1

Analysis date: 11/15/2016 10:44:05

Method: Direct Injection
Description: CHANNEL 2 - PID

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

179.8810

194.5980

0.0000

0.0000

Lab name: ECSI

Client ID: Aer#1

Analysis date: 11/15/2016 10:44:05 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

23.5330

25.3740

## APPENDIX D

Run #2 Chromatograms – Aeration



Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 64.000 17.5390/0.100 Dead Vol / Air 0.0000/ Dead Vol / Air 1.7720/0.233 0.0000/ 0.0000/ 23.5900/0.566 Component Retention Area External Units Component Retention External Units Area Dead Vol / Air 0.233 0.0000 Dead Vol / Air 1.7720 0.100 17.5390 0.0000 Ethylene Oxide 0.566 23.5900 60.5421 ppm Ambient H2O 0.0000 0.400 171.1355

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 2SterST2016-2A01.CHR (c:\peak359)

0.0000

188.6745

Client ID: Aer#2

Analysis date: 11/15/2016 10:49:10 Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-2A01.CHR (c:\peak359)

25.3620

60.5421

Client ID: Aer#2

Analysis date: 11/15/2016 10:49:10 Method: Direct Injection

Description: CHANNÉL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Data file: 1SterST2016-2A02.CHR (c:\peak359) Data file: 2SterST2016-2A02.CHR (c:\peak359) Sample: Abator Outlet Sample: Abator inlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6.400 64.000 19.3110/0.083 Dead Vol / Air 0.0000/ 10000.0 1.7820/0.250 Dead Vol / Air Ambient H2O 174.4040/0.400 0.0000/ 23.1375/0.566 Retention Component Retention External Units Area Component Area External Units Dead Vol / Air 0.250 0.0000 1.7820 Dead Vol / Air 0.083 19.3110 0.0000 Ethylene Oxide 0.566 23.1375 59.3808 ppm Ambient H2O 0.400 0.0000 174.4040

Lab Haille, Looi

Client ID: Aer#2 Analysis date: 11/15/2016 10:54:08

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.0000

193.7150

Lab hame, Ecol

Client ID: Aer#2

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Analysis date: 11/15/2016 10:54:08 Method: Direct Injection

Client: Sterigenics - Santa Teresa

24.9195

59.3808

Description: CHANNEL 1 - FID Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-2A03.CHR (c:\peak359) Data file: 2SterST2016-2A03.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 -6.400 -6.400 Component 15.4750/0.066 Dead Vol / Air 0.0000/ 1.7670/0.233 0.0000/ Dead Vol / Air 171.3175/0.400 Ambient H2O 23,1975/0,550 Component Retention External Units Area Component Retention Area External Units Dead Vol / Air 0.233 1.7670 0.0000 Dead Vol / Air 0.066 15.4750 0.0000

Ambient H2O

Lab name: EUSI

Client ID: Aer#2

Analysis date: 11/15/2016 10:59:17 Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

171.3175

186.7925

0.0000

0.0000

Lab name: ECSI

Client ID: Aer#2

Analysis date: 11/15/2016 10:59:17

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.550

23.1975

24.9645

59.5348 ppm

59.5348

Data file: 1SterST2016-2A04.CHR (c:\peak359) Data file: 2SterST2016-2A04.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 15.1520/0.066 Dead Vol / Air 0.0000/ 1.7680/0.233 Dead Vol / Air 0.00001 Ambient H2O 174,5530/0.400 0.0000/ 23.2530/0.566 59.6772/ppm Component Retention External Units Area Component Retention External Units Area Dead Vol / Air 0.233 1.7680 0.0000 Dead Vol / Air 0.066 15.1520 0.0000

Ambient H2O

Lau Haille. Looi

Client ID: Aer#2

Analysis date: 11/15/2016 11:04:08

Method: Direct Injection

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

0.400

174.5530

189.7050

0.0000

0.0000

Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Lab hallic. Loci

Client ID: Aer#2

Analysis date: 11/15/2016 11:04:08

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

23.2530

25.0210

59.6772 ppm

59.6772

Data file: 1SterST2016-2A05.CHR (c:\peak359) Data file: 2SterST2016-2A05.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6.400 64,000 23.6205/0.083 0.0000/ Dead Vol / Air 1.7790/0.250 Ambient H2O 178.2020/0.416 59.5412/ppm Component Retention Area External Units Component Retention External Units Area

Dead Vol / Air

Ambient H2O

Lad name: ECO

Client ID: Aer#2 Analysis date: 11/15/2016 11:09:20

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.083

0.416

23.6205

178.2020

201.8225

0.0000

0.0000

0.0000

Lad hame: ECOI

Client ID: Aer#2

Analysis date: 11/15/2016 11:09:20 Method: Direct Injection

Description: CHANNEL 1 - FID

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B Carrier: HELIUM

0.250

0.566

1.7790

23.2000

24.9790

0.0000

59.5412

59.5412 ppm

Data file: 1SterST2016-2A06.CHR (c:\peak359) Data file: 2SterST2016-2A06.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6.400 64.000 0.0000/ 0.0000/ Ambient H2O 176.6970/0,400 0.0000/ 23,2780/0,566 59.7414/ppm Retention Component Area External Units Component Retention External Units Area

Dead Vol / Air

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.250

0.566

1.8290

23.2780

25.1070

0.0000

59.7414

59.7414 ppm

Client ID: Aer#2

Analysis date: 11/15/2016 11:14:12

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Ethylene Oxide

Client: Sterigenics - Santa Teresa

0.083

0.400

20.3820

176.6970

197.0790

0.0000

0.0000

0.0000

Client ID: Aer#2

Analysis date: 11/15/2016 11:14:12

Method: Direct Injection

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Hallie. Loo Client: Sterigenics - Santa Teresa Client ID: Aer#2

Analysis date: 11/15/2016 11:19:04 Method: Direct Injection

Description: CHANNEL 1 - FID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto1-100.cpt

Data file: 1SterST2016-2A07.CHR (c:\peak359)

Sample: Abator Inlet Operator: D. Kremer

Client: Sterigenics - Santa Teresa Client ID: Aer#2

Analysis date: 11/15/2016 11:19:04 Method: Direct Injection Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

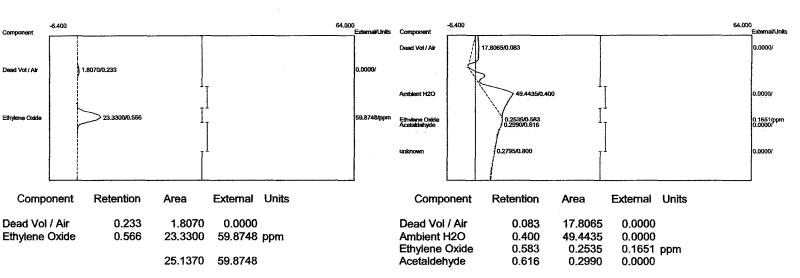
Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterST2016-2A07.CHR (c:\peak359)

67.8025

0.1651

Sample: Abator Outlet Operator: D. Kremer



Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 64.000 Dead Voi / Air 13.4280/0.066 0.0000/ 1.6890/0.233 Dead Vol / Air 0.0000/ Ambient H2O 176.7670/0.400 0.0000/ 60.1789/ppn Component Retention Area External Units Component Retention Area External Units Dead Vol / Air 0.233 1.6890 0.0000 Dead Vol / Air 0.066 13.4280 0.0000 Ethylene Oxide 0.566 23.4485 60.1789 ppm Ambient H2O 0.400 176.7670 0.0000

Lad Harrier Ecol

Client ID: Aer#2

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Analysis date: 11/15/2016 11:24:06

Method: Direct Injection

Client: Sterigenics - Santa Teresa

Data file: 2SterST2016-2A08.CHR (c:\peak359)

190.1950

0.0000

Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Lau name. Econ

Client ID: Aer#2

Analysis date: 11/15/2016 11:24:06

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-2A08.CHR (c:\peak359)

25.1375 60.1789

Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 Fxtem 64.000 6.7455/0.083 Dead Vol / Air 0.0000/ 1,9320/0,233 Dead Vol / Air 0\_0000/ Ambient H2O 181.3360/0.400 0.0000/ 58.0142/ppm Component Retention Area External Units Component Retention Area **External Units** Dead Vol / Air 0,233 1.9320 0.0000 Dead Vol / Air 0.083 16.7455 0.0000 Ethylene Oxide 0.566 22.6050 58.0142 ppm Ambient H2O 0.400 181.3360 0.0000

Lab Haine. Ecoi

Client ID: Aer#2

Analysis date: 11/15/2016 11:29:12

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 2SterST2016-2A09.CHR (c:\peak359)

0.0000

198.0815

Lab Hairie. LUGI

Client ID: Aer#2

Analysis date: 11/15/2016 11:29:12

Method: Direct Injection

Description: CHANNÉL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-2A09.CHR (c:\peak359)

24.5370 58.0142

Data file: 2SterST2016-2A10.CHR (c:\peak359) Data file: 1SterST2016-2A10.CHR (c:\peak359) Sample: Abator Outlet Sample: Abator Inlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 13.6730/0.066 0.0000/ Dead Vol / Air 1.8490/0.233 0.0000/ Dead Vol / Air Ambient H2O 170.2250/0.400 Component Retention Area External Units Retention External Units Component Area Dead Vol / Air 0.066 13.6730 0.0000 0.233 1.8490 0.0000 Dead Vol / Air

Ambient H2O

Lab name. Ecoi

Client ID: Aer#2

Analysis date: 11/15/2016 11:34:38

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

170.2250

183.8980

0.0000

0.0000

Lab name: ECSI

Client ID: Aer#2

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto1-100.cpt

Analysis date: 11/15/2016 11:34:38

Method: Direct Injection
Description: CHANNEL 1 - FID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

21.6490

23.4980

0.566

Ethylene Oxide

55.5607 ppm

55.5607

Sample: Abator Outlet Operator: D. Kremer Sample: Abator Inlet Operator: D. Kremer -6.400 64.000 64.000 15.1620/0,083 Dead Vol / Air 0.0000/ 1.7330/0.233 0.0000/ 21.4130/0.566 54.9550/ppm Component Retention Area External Units Component Retention External Units Area Dead Vol / Air 0.233 1.7330 0.0000 Dead Vol / Air 0.083 0.0000 15.1620 Ethylene Oxide 0.566 54.9550 ppm 21.4130 Ambient H2O 0.400 164.5940 0.0000

Lab name: ECSI

Client ID: Aer#2 Analysis date: 11/15/2016 11:39:39

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

Data file: 2SterST2016-2A11.CHR (c:\peak359)

179.7560

0.0000

Lab hame. ECOI

Client ID: Aer#2

Analysis date: 11/15/2016 11:39:39 Method: Direct Injection

Description: CHANNEL 1 - FID

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B Carrier: HELIUM

Data file: 1SterST2016-2A11.CHR (c:\peak359)

23.1460 54.9550

Data file: 1SterST2016-2A12.CHR (c:\peak359) Data file: 2SterST2016-2A12.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6.400 64.000 17.4670/0.083 0.0000/ 1,8060/0,250 Ambient H2O 166.6530/0.416 0.0000/ 54.6829/ppm Component Retention Area External Units Component Retention Area External Units Dead Vol / Air 0.250 1.8060 0.0000 Dead Vol / Air 0.083 17.4670 0.0000 Ethylene Oxide 0.566 21.3070 54.6829 ppm Ambient H2O 0.416 166.6530 0.0000

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

23.1130 54.6829

Client ID: Aer#2

Analysis date: 11/15/2016 11:44:03

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Lab Haille. Look

Client ID: Aer#2

Analysis date: 11/15/2016 11:44:03

Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

184.1200

0.0000

## APPENDIX E

Run #3 Chromatograms – Aeration



Data file: 1SterST2016-3A01.CHR (c:\peak359) Data file: 2SterST2016-3A01.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6.400 64.000 19.5735/0.083 0.0000/ 173.0950/0.400 Ambient H2O 64.2338/ppm Component Retention External Units Area Component Retention Area External Units Dead Vol / Air 0.250 1.6930 0.0000 Dead Vol / Air 0.083 0.0000 19.5735

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

173.0950

192.6685

0.0000

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 11:49:15 Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

21.1320

22.8250

54.2338 ppm

54.2338

Client ID: Aer#3

Analysis date: 11/15/2016 11:49:15 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 2SterST2016-3A02.CHR (c:\peak359) Data file: 1SterST2016-3A02.CHR (c:\peak359) Sample: Abator Inlet Operator: D. Kremer Sample: Abator Outlet Operator: D. Kremer -6.400 64,000 -6.400 64,000 0.0000/ 1.7950/0.233 0.0000/ Dead Vol / Air 173.0775/0.400 0.0000/ Ambient H2O 21.1320/0.566 54.2338/ppm Ethylene Oxide Component Retention Area External Units Component Retention Area External Units Dead Vol / Air 0.233 1.7950 0.0000 Dead Vol / Air 0.083 16.6060 0.0000

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

173.0775

189.6835

0.0000

0.0000

Client ID: Aer#3 Analysis date: 11/15/2016 11:54:06

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Method: Direct Injection
Description: CHANNEL 2 - PID

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

21.1320

22.9270

54.2338 ppm

54.2338

Client ID: Aer#3

Analysis date: 11/15/2016 11:54:06 Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Temp. prog: eto-100.tem Components: eto1-100.cpt Components: eto2-100.cpt Data file: 1SterST2016-3A03.CHR (c:\peak359) Data file: 2SterST2016-3A03.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 Evternel/Units 27.3245/0.083 0.0000/ 1.7350/0.250 Ambient H2O 180,9530/0,400 0.0000/ 53.0225/ppm Component Retention Area External Units Component Retention Area External Units

Dead Vol / Air

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.083

0.400

27.3245

180.9530

208.2775

0.0000

0.0000

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 11:59:04

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0,250

0.566

0.0000

53.0225

53.0225 ppm

1.7350

20.6600

22.3950

Client ID: Aer#3

Analysis date: 11/15/2016 11:59:04

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Dead Vol / Air

Data file: 1SterST2016-3A04.CHR (c:\peak359) Data file: 2SterST2016-3A04.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6,400 64.000 -6.400 64.000 30,9195/0,150 0.0000/ 2.4510/0.250 0.0000/ Ambient H2O 161.8240/0.400 0.0000/ 20.7960/0.566 Ethylene Oxide 53.3715/ppm Component Retention Area **External Units** Component Retention Area External Units

Dead Vol / Air

Ambient H2O

Lab Haille, Loci

Client ID: Aer#3

Analysis date: 11/15/2016 12:04:43

Method: Direct Injection
Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.150

0.400

30.9195

161.8240

192.7435

0.0000

0.0000

0.0000

Lab Hairie. LOOI

Client ID: Aer#3

Analysis date: 11/15/2016 12:04:43

Method: Direct Injection
Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.250

0.566

0.0000

53.3715

53.3715 ppm

2.4510

20.7960

23.2470

Components: eto1-100.cpt Components: eto2-100.cpt Data file: 2SterST2016-3A05.CHR (c:\peak359) Data file: 1SterST2016-3A05.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 23.6565/0.066 0.0000/ 1.7010/0.250 0.0000/ Dead Vol / Air 0.0000/ 53.4575/ppm Component Retention Area External Units Component Retention External Units Area 0.0000 Dead Vol / Air 0.250 1.7010 Dead Vol / Air 0.066 23.6565 0.0000 Ethylene Oxide 0.566 53.4575 ppm Ambient H2O 0.0000 20.8295 0.400 174.3950

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

198.0515

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 12:09:29 Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

22.5305

53,4575

Client ID: Aer#3

Carrier: HELIUM

Temp. prog: eto-100.tem

Analysis date: 11/15/2016 12:09:29 Method: Direct Injection Description: CHANNEL 1 - FID

Data file: 1SterST2016-3A06.CHR (c:\peak359) Data file: 2SterST2016-3A06.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 -6.400 64.000 25.2095/0.066 0.0000/ 1.7570/0.250 Dead Vol / Air 0.0000/ 0.0000/ 52.9493/ppm Component Retention External Units Area Component Retention External Units Area Dead Vol / Air 0.250 1.7570 0.0000 Dead Vol / Air 0.066 25.2095 0.0000

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

179.3420

204.5515

0.0000

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 12:14:14

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

20.6315

22.3885 52.9493

52.9493 ppm

Client ID: Aer#3

Analysis date: 11/15/2016 12:14:14

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 2SterST2016-3A07.CHR (c:\peak359) Data file: 1SterST2016-3A07.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 64.000 31.1120/0.083 1.9810/0.250 .0000/ 174.1380/0,400 0.0000/ External Units Component Retention Component Retention External Units Area Area 0.0000 Dead Vol / Air 0.250 1.9810 Dead Vol / Air 0.083 31.1120 0.0000

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

174.1380

205.2500

0.0000

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 12:19:15

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

20.6810

22.6620

53.0763 ppm

53.0763

Client ID: Aer#3

Analysis date: 11/15/2016 12:19:15

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 1SterST2016-3A08.CHR (c:\peak359) Data file: 2SterST2016-3A08.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 -6,400 64.000 28.4515/0.166 Dead Vol / Air 0.0000/ Dead Vol / Air 2.1445/0.250 159.1320/0.400 100008.0 49.8760/ppm Component External Units Retention Area Component Retention External Units Area

Dead Vol / Air

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.166

0.400

28.4515

159.1320

187.5835

0.0000

0.0000

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 12:24:13

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.250

0.566

2.1445

19.4340

21.5785 49.8760

0.0000

49.8760 ppm

Client ID: Aer#3

Analysis date: 11/15/2016 12:24:13

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Dead Vol / Air

Data file: 1SterST2016-3A09.CHR (c:\peak359) Data file: 2SterST2016-3A09.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64,000 64.000 Composent Externo/Units ad Vol / Air 29.0010/0.066 0.0000/ 1.7170/0.233 Dead Vol / Air 0.0000/ Ambient H2O 171,1240/0,400 0.0000/ 19.3040/0.566 Component Retention Area External Units Component Retention Area External Units Dead Vol / Air 0.233 1.7170 0.0000 Dead Vol / Air 29.0010 0.0000 0.066

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

171.1240

200.1250

0.0000

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 12:29:14

Method: Direct Injection

Description: CHANNÉL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

19.3040

21.0210

49.5424 ppm

49.5424

Client ID: Aer#3

Analysis date: 11/15/2016 12:29:14

Method: Direct Injection

Description: CHANNÉL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

Data file: 2SterST2016-3A10.CHR (c:\peak359) Sample: Abator Outlet Data file: 1SterST2016-3A10.CHR (c:\peak359) Sample: Abator Inlet Operator: D. Kremer Operator: D. Kremer 64,000 64.000 External/Unit 0.0000/ 0.2080/0.000 1.7010/0.250 Ambient H2O 174.0670/0.400 18.9560/0.566 Component Retention External Units External Units Area Component Retention Area Dead Vol / Air 0.250 1.7010 0.0000 Ambient H2O 0.400 174.0670 0.0000

LOD HOLLIG. LUCK

Client ID: Aer#3

Analysis date: 11/15/2016 12:34:09

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

174.0670

0.0000

HUHITO.

Client ID: Aer#3

Analysis date: 11/15/2016 12:34:09

Method: Direct Injection

Description: CHANNEL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ethylene Oxide

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.566

18.9560

20.6570

48.6493 ppm

48.6493

Data file: 1SterST2016-3A11.CHR (c:\peak359) Data file: 2SterST2016-3A11.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer 64.000 -6.400 64.000 Cytomot/Units 0.1945/0.000 25.9230/0.066 Dead Vol / Air 0.0000/ 1.7855/0.233 Dead Vol / Air 0.0000/ Ambient H2O 179.7290/0.383 0.0000/ 50.2379/ppm Component Component Retention Area External Units Retention External Units Area Dead Vol / Air 0.233 1.7855 0.0000 Dead Vol / Air 0.066 25.9230 0.0000

Ambient H2O

Lab Haine. Low

Client ID: Aer#3 Analysis date: 11/15/2016 12:39:03

Method: Direct Injection

Description: CHANNÉL 2 - PID

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.383

179.7290

205.6520

0.0000

0.0000

Lab name. Loo

Client ID: Aer#3

Carrier: HELIUM

Temp. prog: eto-100.tem Components: eto1-100.cpt

Ethylene Oxide

Analysis date: 11/15/2016 12:39:03 Method: Direct Injection

Client: Sterigenics - Santa Teresa

0.550

19.5750

21.3605

50.2379 ppm

50.2379

Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B

Data file: 1SterST2016-3A12.CHR (c:\peak359) Data file: 2SterST2016-3A12.CHR (c:\peak359) Sample: Abator Inlet Sample: Abator Outlet Operator: D. Kremer Operator: D. Kremer -6.400 64.000 64,000 0.0000/Units 29.9090/0.050 Dead Vol / Air o nonny 1.6920/0.233 0.0000/ Dead Vol / Air Ambient H2O 178,0480/0.400 0.0000/ 17.5000/0.550 Ethylene Oxide 44,9125/ppm Component External Units Retention Area Component Retention Area External Units Dead Vol / Air 0.233 1.6920 0.0000 Dead Vol / Air 0.050 29.9090 0.0000

Ambient H2O

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.400

178.0480

207.9570

0.0000

0.0000

Client ID: Aer#3

Analysis date: 11/15/2016 12:44:01

Method: Direct Injection

Description: CHANNEL 2 - PID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt

Client: Sterigenics - Santa Teresa

Column: 1% SP-1000, Carbopack B

0.550

17.5000

19.1920

44.9125 ppm

44.9125

Client ID: Aer#3

Analysis date: 11/15/2016 12:44:01

Method: Direct Injection

Description: CHANNÉL 1 - FID

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto1-100.cpt

### **APPENDIX F**

**Field Data and Calculation Worksheets** 



# ETHYLENE OXIDE SOURCE TEST/CALIBRATION DATA

Client:	steriaenia	9-4	anta	Teres	a				
Source Te	ested: Dona	Idson	EtC	Aba	tor	· · · · · · · · · · · · · · · · · · ·	I	Date: [ [ / [	5/16
			PR	E CAL	BRATI	ON	and the second section is a second		
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
Inlet	Area Counts #1	.43	4.04	39.D					
(FID)	Area Counts #2	.42	3.97	37.2					
	Average Area	.43	4.01	38.1					
		Aud	it Standard	l (48.8 ppm	v) Result	46.7	1) (48.	1	
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO					
Outlet	Area Counts #1	1.71	15.2	147					
(PID)	Area Counts #2	1.75	15.9	151					
	Average Area	173	15.6	149			1		
		Aud	it Standard	l (48.8 ppm	v) Result	493	N 48.	>, ( )	
ation st	COUR TOUR	10481148	1178/246		l₂O:		EtO Usag Cycles Pe	, , ,	
			POS	ST CAL	IBRAT	ION	1		1
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
Inlet	Area Counts #1								
(FID)	Area Counts #2								
	Average Area								<u> </u>
		Aud	it Standard	(48.8 ppm	v) Result	48.5			
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO					
Outlet	Area Counts #1								
(PID)	Area Counts #2								
	Average Area	- 13.00 s0.00					<b>\</b>		
		Audi	it Standard	(48.8 ppm	v) Result	49.4	(/)		
		, 100		( , c.o pp	,	144.U	<u> </u>		

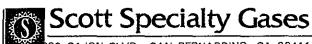
### **APPENDIX G**

**Gas Certifications** 



# **CERTIFIED WORKING CLASS**

Single-Certified Calibration Standard



00 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

# CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

**Product Information** 

Project No.: 02-57164-001 ltem No.: 02020001310TCL P.O. No.: VBL – D. KREMER

Cylinder Number: CAL4448

Cylinder Size: CL

Certification Date: 18Apr2016

Customer

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

**CERTIFIED CONCENTRATION** 

Component Name

ETHYLENE OXIDE NITROGEN Concentration (Moles)

1.10 PPM

Accuracy (<u>+</u>/-%)

5

BALANCE

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:	 $\mathcal{M}($	
	 MT	

DATE: 4-18-16\_\_\_\_

Page 1 of 2

SPECIFICATIONS	Requested Concentration	Certified Concentration	Blend Tolerance Resuit	Certified Accuracy Result	
Component Name	(Moles)	(Moles)	(+/- %)_	(+/- %)	
BIHYLENE OXIDE	l. PR		10.0	5.00	

#### **TRACEABILITY**

Traceable To Scott Reference Standard

#### PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure:

1300 PSIG

Expiration Date: 18Apr2018

#### SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

#### **COMMENTS**

# CERTIFIED WORKING CLASS

Single-Certified Calibration Standard



00 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

### CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

**Product Information** 

Project No.: 02-57164-003 Item No.: 02020001320TCL P.O. No.: VBL - D. KREMER

Cylinder Number: CLM003232 Cylinder Size: CL Certification Date: 18Apr2016

Customer

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE NITROGEN

Concentration (Moles)

10.1

PPM BALANCE Accuracy (+/-%)

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:		DATE:	4-18-16
	MT		

SPECIFICATIONS  Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
ETHYLENE OXIDE	10.	PPM BAL	10.1	PPM BAL	1.0	5.00	

#### **TRACEABILITY**

Traceable To Scott Reference Standard

#### PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure:

1400 PSIG

Expiration Date: 18Apr2018

#### SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

#### **COMMENTS**

# **CERTIFIED WORKING CLASS**

## Single-Certified Calibration Standard



Phone: 909-887-2571 Fax: 909-887-0549

### CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-004 Item No.: 02020001330TCL P.O. No.: VBL – D. KREMER

Cylinder Number: CLM011385 Cylinder Size: CL

Certification Date: 18Apr2016

Customer

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

**CERTIFIED CONCENTRATION** 

Component Name

ETHYLENE OXIDE NITROGEN

Concentration (Moles)

100.

PPM BALANCE

5

Accuracy

(+/-%)

**TRACEABILITY** 

Traceable To

Scott Reference Standard

APPROVED BY:

B-Mª Cully

DATE: 4-18-16

Page 1 of 2

SPECIFICATIONS  Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
ETHYLENE OXIDE	100.	PFM BAL	100.	PPM BAL	.0	5.00	

#### **TRACEABILITY**

Traceable To

Scott Reference Standard

#### PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: Expiration Date: 18Apr2018

1400 PSIG

Valve Connection: CGA 350

### SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

#### **COMMENTS**

# CERTIFIED WORKING CLASS

Single-Certified Calibration Standard



Phone: 909-887-2571 Fax: 909-887-0549

# CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

**Product Information** 

Project No.: 02-57164-005 Item No.: 02020001340TCL P.O. No.: VBL – D. KREMER

Cylinder Number: CLM002810 Cylinder Size: CL Certification Date: 18Apr2016 Customer

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

**CERTIFIED CONCENTRATION** 

Component Name

ETHYLENE OXIDE NITROGEN Concentration (Moles)

1.000.

PPM BALANCE Accuracy (+/-%)

5

**TRACEABILITY** 

Traceable To-

Scott Reference Standard

APPROVED BY:

BLM

DATE: 4-18-16

Page 1 of 2

SPECIFICATIONS  Component Name	Requested Concentration (Moles)		Certified Concentration {Moles}		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
ETHYLENE OXIDE	1,000.	PPM BAL	1,000.	PPM BAL	.0	5.00	

#### **TRACEABILITY**

Traceable To Scott Reference Standard

#### PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure:

1300 PSIG

Valve Connection: CGA 350

Expiration Date: 18Apr2018

#### SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

#### **COMMENTS**

# CERTIFIED WORKING CLASS

Single-Certified Calibration Standard



Phone: 909-887-2571 Fax: 909-887-0549

### CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

**Product Information** 

Project No.: 02-57164-006 Item No.: 02020001340TCL P.O. No.: VBL - D. KREMER

Cylinder Number: CLM005787 Cylinder Size: CL

Certification Date: 18Apr2016

Customer

ECSI, INC **PO BOX 848** 

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE **NITROGEN** 

Concentration (Moles)

10,080.

PPM

BALANCE

Accuracy (+/-%)

5

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:

DATE: 4-18-16

Page 1 of 2

SPECIFICATIONS  Component Name.	Requested Concentration (Moles)		Certified Concentration (Moles)		. Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
ETHYLENE OXTDE NITROGEN	10,000.	PPM BAL	10,080.	PPM BAL	. 8	5.00	

#### TRACEABILITY

Traceable To

Scott Reference Standard

#### PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: Expiration Date: 18Apr2018

800 PSIG

Valve Connection: CGA 350

#### SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

#### COMMENTS



#### CERTIFICATE OF ANALYSIS

Customer Name:

Stock or Analyzer Tag Number:

Customer Reference: MESA Reference:

Date of Certification:

Recommended Shelf Life:

ECSi, Inc.

N/A

Verbal- Dan

104448

4/20/2016 2 Years

Cylinder Number:

**Product Class:** 

Cylinder - Contents<sup>1</sup>: Cylinder-CGA:

Analysis Method:

Preparation Method:

SA25925

Certified Standard

28 CF @ 2000 PSI

A006-HP-BR/350

GC-TCD/FID Gravimetric

Component

Ethylene Oxide

Nitrogen

Requested Concentration<sup>2</sup>

> 50 ppm Balance

Reported Concentration<sup>2,3</sup>

48.8 ppm Balance

Authorized Signature:

1. The fill pressure shown on the COA is as originally quoted. The fill pressure measured by the customer may differ from the fill pressure originally quoted due to temperature effects, compressibility of the individual components when blended together in the cylinder, gauge accuracy or reduction in content volume before shipping as a result of samples withdrawn for laboratory QC necessary to ensure product quality.

2. Unless otherwise stated, concentrations are given in molar units.

3. Vapor pressure mixes are blended at a sufficiently low pressure so as to eliminate phase separation under most low temperature conditions encountered during transport or storage. However, it is generally recommended that cylinders containing vapor pressure restricted mixes be placed on the floor in a horizontal position and rolled back and forth to improve homogeneity of the gas phase mixture before being put into service.

Analytical Gas Standards are prepared and analyzed using combinations of NIST traceable weights, SRM's provided by NIST, or internal gas standards that have been verified for accuracy using procedures published by the US-EPA. Pure gases are analyzed and certified for purity using minor component Analytical Gas Standards prepared according to the methods specified above. Balances are calibrated to NIST test weights covered by NIST test number 822/256175/96. Reference Certification #'s: 163/W, 830/N and 3280. Calibration methods are in conformance with MIL-STD 45662A.

MESA Specialty Gave & Equipment division of MESA International Technologies, Inc.
3619 Pendleton Avenue, Suite C. ◆ Santa Ana, California 92704 ◆USA

TEL: 714-434-7102 • FAX: 714-434-8006 • E-mail: mail@mesagas.com On-line Catalog at www.mesagas.com